Creating a Choropleth Map
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Introduction
A map's greatest strength is its ability to quickly tell a story with data. A good map will show the reader something within just a minute or so, and the best maps for this are called choropleth maps. A choropleth map is a map that uses fixed boundaries and a consistent symbology to illustrate facts about the places mapped. For example, Figure 1 shows the population density, or number of people per square kilometer, of Europe.
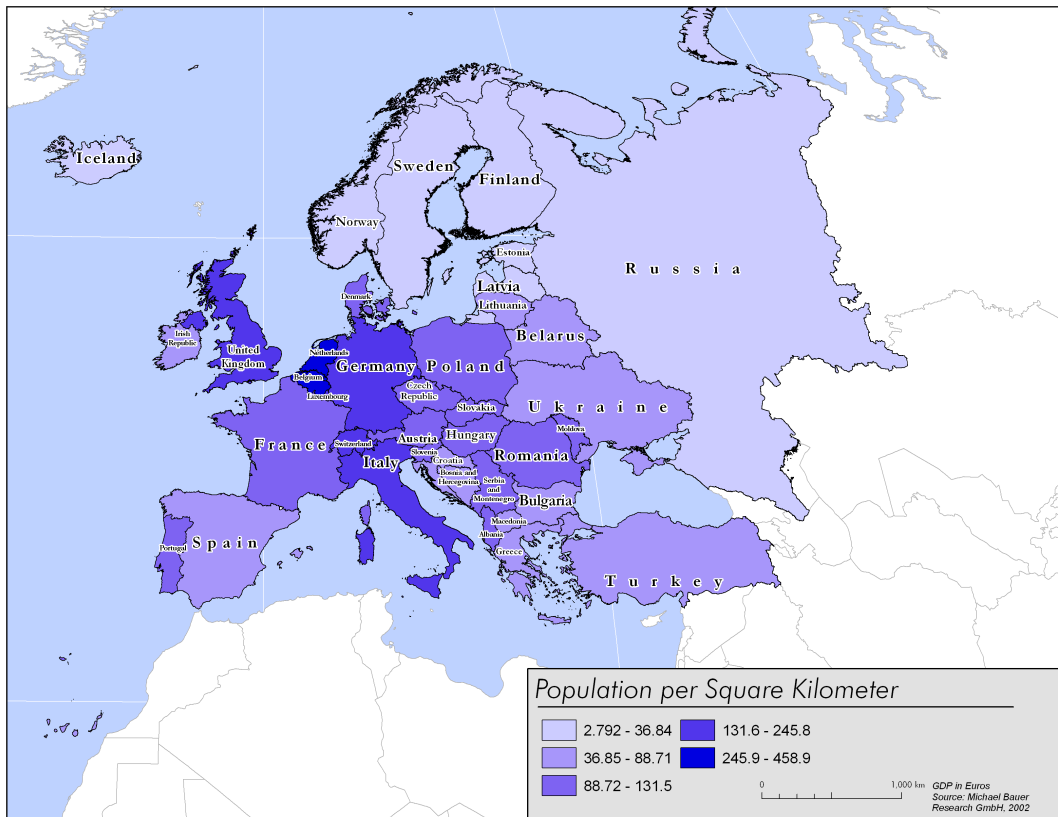

Figure 1. Choropleth map of Europe's population density.

Mapping Internet use in the Middle East
For this exercise, you will make a series of **three choropleth maps** illustrating population counts in the Middle East. Your first map will show the population growth of each country in the region. The second map will show children aged 14 and under as a percentage of the total population. The third map will show seniors aged 65 and above as a percentage of the total population.

Before you begin to color in countries on the maps below, you will need to think about the information you are trying to present to determine the best way to visualize it.

First you need to look at your data. All of the data you will need for this lab is provided in Figure 3. Your first map will be showing the population growth rate in the Middle East, and of course, those values filled out in the table. You'll have to do some work before your data is ready to map.

Population growth can be found with the formula

$$\text{Growth Rate (\%)} = \left(\frac{\text{(Population at end of time period - pop. at start)}}{\text{Population at start of time period}} \right) \times 100$$

1. **Use this formula to fill in the missing values in Figure 3.**

Now that you have all of your data you can begin to sort out the values and have a good idea as to how you will make your first map.

2. **Which country has the highest amount of population growth? What is it?**

3. **Which country has the lowest amount? What is it?**

Mapping every single value of population growth with a unique color would make for an incomprehensible map. Instead of mapping unique values, a choropleth map places each value into a classification. For example, data values ranging from 0-25% could be placed into one classification, 25.1-50% into another, and so on. Such a map should have no fewer than four and no more than six classifications. Using fewer classifications will present too simple of a picture and using more than six will make the map difficult to read. Typically we use a statistical method like *Jenks Natural Breaks* to properly classify data, but you will simply come up with a classification scheme that seems to fit the data.

4. **Looking at your data values for population growth, create 4-6 classifications that you think would make a meaningful map.** *Keep your high and low values in mind; if your high value is 72%, you would not need to have a classification go any higher*. **Write your classification scheme here.**

Now that you have a classification scheme you will need to come up with the *symbology* you will use to map it. Since a choropleth map is designed to convey a story with the data, you want to choose a symbology that best fits the data. Figure 2 shows three different symbology schemes that can be used for choropleth maps.

(a) Single Color Progression

(b) Bi-Color Progression

(c) Unique Symbology

(d) Unique Symbology (black and white)
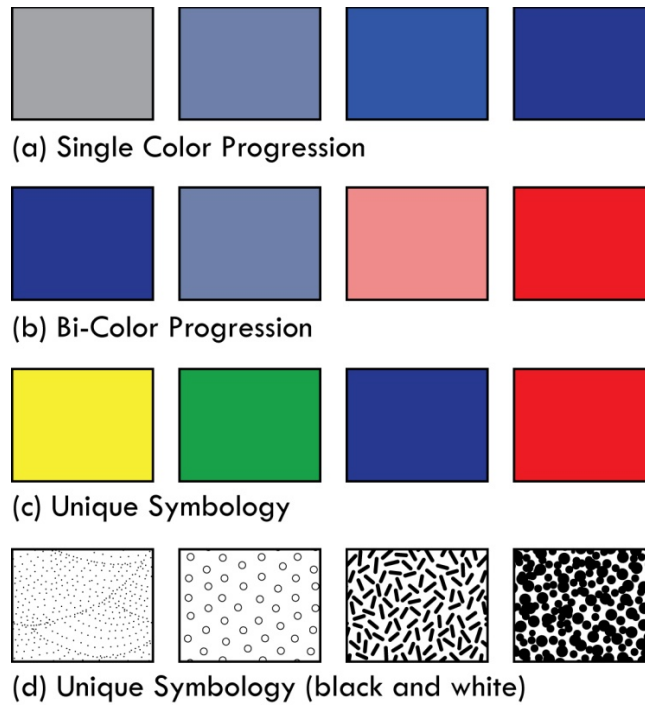
Figure 2. Symbology schemes for choropleth maps.

The single color progression uses lighter to darker shades of a color to indicate more or less of a certain thing. The bi-color progression is typically used to highlight both high and low values of a phenomenon. Unique symbology is used to show classifications that are unique of each other and do not necessarily indicate a high or low value.

5. **Based on the population growth data, which symbology scheme would be best for your data? Why?**

6. **Draw and color the symbology as it relates to your data classification:**

You now have a classification scheme and symbology for your map. Using the first blank map of the Middle East provided, create your map of the population growth in the region. Give the map a title and a legend for the symbology in the blank rectangle in the lower left of the map. Then begin going through your data and symbolizing each country based on their growth. *Use your atlas if you have any doubts as to the exact boundaries of a country.*

Use the steps above to make two more maps, one for the children aged 14 and under as a percentage of the total population and one for seniors aged 65 and above as a percentage of the total population.

Once your three maps are complete, answer the following questions.

7. What do maps of the amount of children and seniors in a country tell you about a place?

8. What interesting trends do you notice when comparing your three maps?

Country Name	Total pop., 2000	Total pop., 2009	Population Growth	Pop. Ages 0-14 %, 2009	Pop. Ages 65+ %, 2009
World	6,084,959,036	6,775,235,741	11.34%	27	8
Afghanistan	23,630,320	29,802,724		46	2
Armenia	3,075,811	3,082,951		20	11
Azerbaijan	8,048,535	8,781,100		24	7
Bahrain	650,012	791,473		26	2
Eritrea	3,657,325	5,073,279		42	2
Ethiopia	65,514,626	82,824,732		44	3
Georgia	4,744,750	4,260,333		17	14
Iran	63,938,646	72,903,921		24	5
Iraq	25,108,525	31,494,287		41	3
Israel	6,289,000	7,441,700		28	10
Jordan	4,797,500	5,951,000		34	4
Kazakhstan	14,883,600	15,888,000		24	7
Kuwait	2,190,000	2,794,706		23	2
Kyrgyzstan	4,915,300	5,321,355		29	5
Lebanon	3,772,283	4,223,553		25	7
Oman	2,402,184	2,845,415		31	3
Pakistan	138,080,000	169,708,303		37	4
Qatar	616,817	1,409,423		16	1
Saudi Arabia	20,644,121	25,391,100		32	3
Syria	16,510,861	21,092,262		35	3
Tajikistan	6,172,891	6,952,223		37	4
Turkey	66,459,578	74,815,703		27	6
Turkmenistan	4,501,727	5,109,881		29	4
United Arab Emirates	3,238,054	4,598,600		19	1
Uzbekistan	24,650,000	27,767,100		29	4
West Bank & Gaza	3,004,150	4,043,218		45	3
Yemen	18,181,733	23,580,220		44	2

Source: World Bank, 2011

Figure 3. Population data for the Middle East.

KAZAKHSTAN

KYRGYZSTAN
Bishkek

CHINA

TAJIKISTAN
Tashkent
Dushanbe

UZBEKISTAN

Syr Darya R.

Ganges River

New Delhi

INDIA

Islamabad

Indus River

Kabul

AFGHANISTAN

PAKISTAN

Amu Darya River

TURKMENISTAN

Ashgabat

IRAN

20° N

65° E

60° E

Arabian Sea

Muscat

OMAN

United Arab Emirates

Abu Dhabi

Doha

QATAR

Al Manamah

BAHRAIN

15° N

Tehran

Baku

Caspian Sea

AZERBAIJAN

Yerevan

ARMENIA

T'Bilisi

GEORGIA

RUSSIA

Kuwait

KUWAIT

Baghdad

Tigris River

Riyadh

SAUDI ARABIA

YEMEN

San'a

Fırat R.

Murat R.

Euphrates R.

IRAQ

SYRIA

Damascus

JORDAN

Amman

Jerusalem

ISRAEL

Beirut

LEBANON

Nicosia

CYPRUS

WEST BANK

GAZA STRIP

Cairo

EGYPT

Red Sea

ERITREA

Asmara

ETHIOPIA

Khartoum

Blue Nile

White Nile

Nile River

SUDAN

LIBYA

CHAD

Ankara

TURKEY

Black Sea

UKRAINE

ROMANIA

Bucharest

Danube R.

Sofya

BULGARIA

GREECE

1:18,750,000
Data Source: ESRI, Redlands, California, 2004

Winkel Tripel Projection

0   200 mi.

Ganges River

New Delhi

INDIA

CHINA

Islamabad

Indus River

PAKISTAN

Kabul

AFGHANISTAN

KAZAKHSTAN

Bishkek

KYRGYZSTAN

Tashkent

TAJIKISTAN

Dushanbe

Syr Darya R.

UZBEKISTAN

Amu Darya River

TURKMENISTAN

Ashgabat

IRAN

Tehran

Muscat

OMAN

Arabian Sea

20° N

65° E

60° E

15° N

United Arab Emirates

Abu Dhabi

QATAR Doha

BAHRAIN Al Manamah

Kuwait

KUWAIT

SAUDI ARABIA

Riyadh

YEMEN

San'a

Caspian Sea

Baku

AZERBAIJAN

ARMENIA

Yerevan

T'Bilisi

GEORGIA

Fyrat R.

Murat R.

Baghdad

Tigris River

Euphrates R.

IRAQ

RUSSIA

UKRAINE

Black Sea

Ankara

TURKEY

Nicosia

CYPRUS

LEBANON Beirut

Damascus

SYRIA

JORDAN

Amman

Jerusalem

ISRAEL

WEST BANK

GAZA STRIP

Cairo

EGYPT

LIBYA

CHAD

SUDAN

Khartoum

Blue Nile

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Asmara

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